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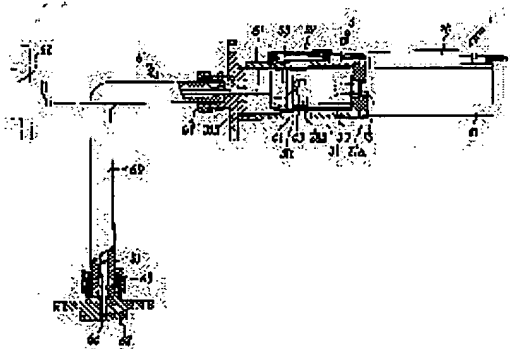
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(54) FLUID PRESSURE CYLINDER HAVING STROKE SENSOR

(57)Abstract:

PURPOSE: To provide a fluid pressure cylinder having a stroke sensor capable of detecting the existence, position, working condition, etc., of a work to be measured when it is difficult to make a direct sensing of the position, the working condition, etc., of the work to be measured by the sensor.

CONSTITUTION: A chuck holder 30 where a stroke detecting rod 51 is held at the tip of a piston rod of a fluid cylinder is fitted. The chuck holder 30 is capable of fixing the stroke detecting rod 51 at an arbitrary position in the axial direction. A position detecting sensor 20 to detect the position of the tip of the stroke detecting rod 51 is added to the fluid cylinder.



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CLAIMS

[Claim(s)]

[Claim 1] It is the hydrostatic-pressure cylinder with a stroke sensor which attaches the chuck holder with which the stroke detection rod which formed with a ***** wire rod elastically at the tip of the piston rod of a hydrostatic-pressure cylinder made support, and is characterized by what the above-mentioned chuck holder made what is fixable to shaft orientations in the location of arbitration the stroke detection rod it made a rod support, and the location detection sensor which detects the tip location of a stroke detection rod with the movement magnitude of the piston in the above-mentioned hydrostatic-pressure cylinder attached for.

[Claim 2] The hydrostatic pressure cylinder with a stroke sensor according to claim 1 characterized by what the guide tube with the flexibility for guiding sliding of the stroke detection rod by the drive of a hydrostatic pressure cylinder was prepared, this rod was inserted free [sliding], and the measurement criteria location was set up at the tip of the guide tube for.

[Claim 3] The hydrostatic pressure cylinder with a stroke sensor according to claim 1 characterized by what the guide tube with the shape memory nature for guiding sliding of the stroke detection rod by the drive of a hydrostatic pressure cylinder was prepared, this rod was inserted free [sliding], and the measurement criteria location was set up at the tip of the guide tube for.

[Claim 4] The hydrostatic pressure cylinder with a stroke sensor according to claim 1 to 3 characterized by what the stroke detection rod was formed with the fiber-optic cable, and the detection control unit which detects the contact or approach at the tip of a stroke detection rod to a measuring object object based on a light-receiving output was connected to that interface for while carrying out opposite arrangement of the optical fiber interface which has a light emitter and receiver in the end face of this fiber-optic cable.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] For example, in a production line or a processing machine, in order to carry out supply arrangement of the measuring object object serially and to give them of a crookedness path or an obstruction a certain processing and processing to the measuring object object, it is not rare to perform detection of existence of the measuring object object itself or its supply location. Moreover, there is also a demand of wanting to detect whether processing predetermined in a narrow location like the interior of the hole of small aperture being performed.

[0002] This invention is used when it is difficult to carry out sensing of the location and processing condition of such a measuring object object directly, and it relates to the hydrostatic pressure cylinder with a stroke sensor for making it possible to detect the existence or nonexistence of the measuring object object, the processing condition of a location or a narrow location, etc.

[0003]

[Description of the Prior Art] In a production line or a processing machine, if the processing and processing by the processing machine are performed in the condition that a measuring object object shifts from the supply location of normal, and it moves, or there is nothing into the installation posture of normal when supply arrangement is carried out and a measuring object object is serially processed on a processing location, a tool and a measuring object object may be damaged. In order to prevent this, it is necessary to perform detection of the existence or nonexistence or the location of the measuring object object itself, or a posture, and he usually arranges a certain sensor in the supply location of the measuring object object in that case beforehand, and is trying to detect that the measuring object object was supplied there correctly.

[0004] Like variety production, however, when the configuration of a measuring object object always is not fixed A sensor cannot be arranged in the supply location of a measuring object object fixed in many cases. When they of a crookedness path or an obstruction have the supply location of a measuring object object especially, monitor by viewing and detection cannot be performed, either but offer of the sensor which can be attached simply is desired to detect whether processing predetermined in a narrow location like the interior of the hole of small aperture is performed. Moreover, since the measuring object object supplied to the position shifts from the supply location of normal and moves by the location gap at the time of vibration of a machine or supply etc., in order to perform reliable detection, offer of the sensor which can be additionally installed in the existing device if needed is also desired.

[0005]

[Problem(s) to be Solved by the Invention] This invention tends to offer the sensor which fills the demand mentioned above, and the technical technical problem is in offering the hydrostatic-pressure cylinder with a stroke sensor which can detect the existence or nonexistence of the measuring object object, the processing condition in a location or a

narrow location, etc., when it is difficult to carry out sensing directly by the sensor in which the location and the processing condition of a measuring object object were attached by the device. Other technical technical problems of this invention are to offer the hydrostatic pressure cylinder with a stroke sensor whose setup of a metrics location was enabled while they guide the ***** stroke detection rod which a tip is contacted in a measuring object object and performs the existence and detection of a location with a guide tube and stabilize frequent appearance migration of the above-mentioned rod with the guide. By using a fiber-optic cable as the above-mentioned stroke detection rod, the technical technical problem of further others of this invention checks the physical relationship of the tip of this rod, and a measuring object object, and is to offer the hydrostatic pressure cylinder with a stroke sensor which enabled it to perform behavior control of a cylinder etc.

[0006]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, according to this invention, at the tip of the piston rod of a hydrostatic pressure cylinder Attach the chuck holder with which the stroke detection rod elastically formed with the ***** wire rod was made to support, and it sets to the above-mentioned chuck holder. Immobilization of the stroke detection rod which it was made to support is enabled in the location of arbitration at shaft orientations. The hydrostatic pressure cylinder with a stroke sensor characterized by attaching the location detection sensor which detects the tip location of a stroke detection rod with the movement magnitude of the piston to the above-mentioned hydrostatic pressure cylinder is offered.

[0007] Moreover, according to this invention, in the above-mentioned hydrostatic pressure cylinder, a guide tube with the flexibility for guiding sliding of the stroke detection rod by the drive of this hydrostatic pressure cylinder or a guide tube with shape memory nature is prepared, this rod is inserted free [sliding], and the hydrostatic pressure cylinder with a stroke sensor which set up the measurement criteria location at the tip of the guide tube is offered. Furthermore, according to this invention, the above-mentioned stroke detection rod is formed with a fiber-optic cable, and while carrying out opposite arrangement of the optical fiber interface which has a light emitter and receiver in the end face of this fiber-optic cable, the hydrostatic pressure cylinder with a stroke sensor which connected to that interface the detection control unit which detects the contact or approach at the tip of the above-mentioned rod to a measuring object object based on a light-receiving output is offered.

[0008]

[Function] According to the hydrostatic pressure cylinder with a stroke sensor which has the above-mentioned configuration, on the occasion of measurement of the location of a measuring object object, double the tip of a stroke detection rod with a measurement criteria location beforehand, but This measurement criteria location can be suitably set up according to the arrangement condition of this rod, and the proper location of a measuring object object applies the tip of the above-mentioned rod to an object by the drive of a hydrostatic pressure cylinder, and is measured by the location detection sensor as migration length of the piston from the above-mentioned measurement criteria location. If there is this rod tip location within proper limits, an object shall exist in a normal location and an object will not be detected within proper limits in a location detection sensor in case the existence or nonexistence of a measuring object object are

detected, it becomes having no object. Thus, measurement of the dimension to the object from a measurement criteria location, the dimension in a narrow location like the interior of the hole of small aperture, the existence or nonexistence of a measurement object, etc. is attained by the above-mentioned location detection sensor.

[0009] Furthermore, although location measurement of an object while avoiding an obstruction with this rod by preparing a guide tube with the flexibility for guiding sliding of the above-mentioned stroke detection rod, and dimension measurement are attained In this case, since the tip of a rod stops suiting the measurement criteria location set up at the tip of a guide tube by crookedness of a guide tube, What is necessary is to make a rod it appear frequently with slight accuracy that the tip of the above-mentioned rod suits beforehand the measurement criteria location suitably set up at the tip of a guide tube by actuation of a chuck holder, and just to double the tip with a measurement criteria location.

[0010] Moreover, if the path of the above-mentioned rod is set up by forming the above-mentioned guide tube for the material which has shape memory nature, since the path of this rod is fixable, Even if a guide tube may carry out oscillating deformation by vibration of a machine, an impact, etc. or the location may change, to return it to the storage configuration which is in a proper condition immediately, and the tip location of a rod seems not to be out of order to a measurement criteria location. If a fiber-optic cable is used as the above-mentioned stroke detection rod, by furthermore, the reflected light obtained through the inside of this cable Contiguity of the measuring object object to the existence or this cable tip of a measuring object object is detectable. By fluctuation in the that case of reflected lights, for example, the amount It detects that the tip of a fiber-optic cable approached before [several mm] the measuring object object, a switching device is operated, and behavior control of the cylinder of adjusting the drive rate of a piston is also attained by control of the driving pressure force of a cylinder in the location.

[0011]

[Example] It is what shows the 1st example of the hydrostatic pressure cylinder with a stroke sensor which drawing 1 thru/or drawing 3 require for this invention explaining to a detail hereafter, referring to a drawing for the example of this invention. This hydrostatic pressure cylinder with a stroke sensor The air cylinder section 1 which consists of the cylinder 10 and the location detection sensor 20 of a hydrostatic pressure drive roughly, It has the detection control unit 3 driven in the above-mentioned cylinder 10, and the guide tube 6 for guiding sliding of the stroke detection rod 51 held at the chuck holder 30 in this detection control unit 3. the detection control unit 52 which the above-mentioned detection control unit 3 was equipped with the chuck holder 30 which supports the stroke detection rod 51 which consists of a fiber-optic cable, and was connected to this stroke detection rod 51 -- external -- it is a thing the bottom.

[0012] The above-mentioned air cylinder section 1 consists of a cylinder 10 and a location detection sensor 20, as shown in a detail at drawing 2 . The above-mentioned cylinder 10 While fixing airtightly a cylinder-head cover 12 and a rod cover 13 to the centrum both ends of a cylinder tube 11 and interpolating a piston 14 in them free [sliding] among these coverings Make a rod cover 13 penetrate the piston rod 15 of this piston 14 and one airtightly and free [sliding], it is made to project outside, and opening of the ports 17a and 17b is carried out to head room 16a and rod room 16b which were divided at the piston 14, respectively. And the magnetic scale 18 which has the magnetic

memory which prepared the magnetic part and the nonmagnetic part in the side face of the above-mentioned piston rod 15 at fixed spacing by turns is attached in the direction of an axis.

[0013] The location detection sensor 20 consists of a magnetometric sensor 21 which detects the above-mentioned magnetic scale 18, and circuit block 22 which built in the digital disposal circuit which processes the detecting signal from this magnetometric sensor 21. The above-mentioned magnetometric sensor 21 consists of permanent magnet 21a which generates magnetic flux, and magnetic resistance elements 21b and 21c which are two from which electric resistance changes according to flux density, in the hold circles prepared in the cylinder tube 11 and the rod cover 13, it is arranged so that the magnetic scale 18 on the above-mentioned piston rod 15 may be attended, and it is being fixed to the location with the bracket 23 attached in the cylinder tube 11. If the magnetic scale 18 displaces this magnetometric sensor 21 by the drive of the above-mentioned piston 14, the sinusoidal signal of the period according to spacing of magnetic memory will be acquired by two magnetic resistance elements 21b and 21c, respectively.

[0014] Furthermore, the above-mentioned circuit block 22 holds the ceramic substrate 24 and the synthetic-resin substrate 25 which carried out division loading of the above-mentioned digital disposal circuit in metal casing 26 at a laminating condition. It is what was constituted by carrying out the mold of both the substrates to one with synthetic resin in the condition of having connected circuits mutually. This circuit block 22 is fixed to a cylinder tube 11 with a screw 27, and the digital disposal circuit in this circuit block is connected with the above-mentioned magnetometric sensor 21 by the flexible print code 28.

[0015] The above-mentioned digital disposal circuit consists of the differential amplifier section which amplifies the detecting signal from the above-mentioned magnetometric sensor 21, an electrical-potential-difference comparator which subdivided the amplified signal electrically and was equipped with the comparator of a large number in comparison with a reference value, and the logical-operation section which changes and outputs the output signal from this electrical-potential-difference comparator to a pulse signal, and detects the movement magnitude of the above-mentioned piston rod 15 by carrying out counting of the pulse number outputted from this logical operation section with a counter. The movement magnitude of the tip location of the stroke detection rod 51 is detected by the movement magnitude of this piston rod. In addition, about the detailed configuration of the above-mentioned location detection sensor 20, it is indicated by JP,3-96704,A, for example.

[0016] On the other hand, said detection control unit 3 is held for the direction of an axis in the case 31 of the shape of a cylinder which formed the chuck holder 30 for supporting the stroke detection rod 51 fixed to the cylinder 10, enabling free sliding, as shown in drawing 1 . Fix the body of the chuck holder 30 at the tip of the above-mentioned piston rod 15, and the above-mentioned stroke detection rod 51 is formed with a fiber-optic cable. the detection control unit 52 for detecting and controlling the light emitting/receiving to the rod 51 in a case 31 -- external -- it is a thing the bottom and the guide tube 6 for guiding sliding of the direction of an axis of the above-mentioned stroke detection rod 51 is connected at the tip of the above-mentioned case 31.

[0017] As shown in a detail at drawing 3 , the above-mentioned chuck holder 30 is equipped with anterior part body 32a and posterior part body 32b which ****ed mutually

and were combined, and is arranging the collet chuck 35 for supporting and releasing the above-mentioned stroke detection rod 51 for the direction of an axis in the feed hole 33 of anterior part body 32a, enabling free sliding. This collet chuck 35 equips a part of that periphery with taper side 35a whose diameter is reduced from a tip side to an end face side. It is what ***(ed) two or more slits (illustration abbreviation) of the direction extended from a core to a radial, and divided this part into the tip side of the collet chuck 35 containing the part at plurality. The taper side 35a is made to contact taper-like inside 33a in the above-mentioned feed hole 33, and it forms in the core possible [support and release of the stroke detection rod 51] by the expanding and contracting accompanying shaft-orientations migration of a collet chuck 35.

[0018] Moreover, the conical cam 36 which has in a perimeter the above-mentioned taper side 35a and conical-surface 36a whose diameter was reduced in this direction at the above-mentioned collet chuck 35 is screwed on the end face side. The body prolonged from the diameter expansion section of the above-mentioned conical-surface 36a ****s to the inner skin of anterior part body 32a, and it is shown to sliding to the shaft orientations of this conical cam 36 to this conical cam 36, and further, it **** the backup spring 37 between that conical cam 36 and the above-mentioned anterior part body 32a, and is energized in the direction in which a collet chuck 35 reduces the diameter of the hole of that core with this spring 37.

[0019] On the other hand, the release ring 38 of which support of the above-mentioned stroke detection rod 51 is made to cancel by energization to the diameter reduction direction is arranged in the perimeter of conical-surface 36a of a conical cam 36 in the above-mentioned anterior part body 32a. This release ring 38 excises a part of ring-like member, and it is energized in the extension direction with the return spring 39 attached in the inner circumference. Moreover, by fitting into the actuation hole 40 which attached around anterior part body 32a small projection 38a which protruded on several [around this release ring 38], respectively The device for canceling support of the stroke detection rod 51 by the collet chuck 35 is made to form, preventing migration to the shaft orientations of the above-mentioned release ring 38.

[0020] Namely, since the above-mentioned release ring 38 is making the small projection 38a face outside through the actuation hole 40 of anterior part body 32a If the diameter of the open ring 38 is made to reduce and those small projection 38a is suitably pressed inside with a means The diameter of the release ring 38 will be reduced and conical-surface 36a of a conical cam 36 will be pressed by the inner skin. Therefore, a conical cam 36 resists the energization force of the backup spring 37, it slides in the direction of an axis, the slit section of the above-mentioned collet chuck 35 opens, and support of the stroke detection rod 51 is released. In order to hold in the condition of having released support of the above-mentioned stroke detection rod 51, or having released it, the release auxiliary ring 41 attached in the perimeter of anterior part body 32a can also be used.

[0021] This release auxiliary ring 41 excises a part of ring-like elastic member energized in the diameter reduction direction. Boss 41a which bound tight to anterior part body 32a, was attached in the condition, and opposite-*(ed) to small projection 38a of the above-mentioned release ring 38 in several inner circumference by fitting into the slot 43 which stands in a row in the actuation hole 40 of anterior part body 32a, respectively It is what made movable the periphery of anterior part body 32a to shaft orientations. By actuation of this release auxiliary ring 41 Support of the stroke detection rod 51 by the collet chuck

35 can be canceled like the case where it mentions above, by moving the boss 41a to the location of the above-mentioned actuation hole 40, and holding in the condition of having pressed small projection 38a of the release ring 38 to the inner direction. Diameter reduction actuation of the open ring 38 mentioned above is performed through two or more actuation hole 31c (refer to drawing 1) prepared in said case 31 where the chuck holder 30 is held.

[0022] The above-mentioned stroke detection rod 51 formed with the fiber-optic cable which has a ***** property elastically is supported by the location of the arbitration of shaft orientations possible [immobilization] by the collet chuck 35 in the above-mentioned chuck holder 30, and opposite arrangement of the optical fiber interface 44 which has a light emitter and receiver is carried out at the end face. This optical fiber interface 44 is energized through the holder 45 attached in it in the direction which makes the stroke detection rod 51 project with the bias spring 46 infixed between posterior part body 32b, and is further connected to the above-mentioned case 31 by the flexible cable 47 at the external ***** detection control unit 52 (refer to drawing 1).

[0023] The above-mentioned optical fiber interface 44 is equipped with the projector which projects light on the surface of an object through the inside of a fiber-optic cable, and the electric eye which receives the reflected light from an object front face, and is outputted to the above-mentioned detection control unit 52. Moreover, the above-mentioned detection control unit 52 detects the contact or approach at the tip of the above-mentioned stroke detection rod to a measuring object object based on the light-receiving output of an electric eye, outputs a required control signal, and holds in configuration the substrate in which the digital disposal circuit was carried in metal casing 53 like said circuit block 22 so that it may mention later.

[0024] As shown in drawing 1 , the cylinder-like case 31 where end-plate 31a was prepared fixed to the cylinder 10 prepares the flange for immobilization to various devices in end-plate 31b of another side, and is inserting in this end-plate 31b loosely the stroke detection rod 51 which the chuck holder 30 was made to support. The above-mentioned chuck holder 30 screws the tip of a piston rod 15 in the tapped hole 54 (refer to drawing 3) established in the back end of the posterior part body 32b, and it holds it so that it may slide on the inside of a case 31 in the direction of an axis by the drive of a piston 14 and the supported stroke detection rod 51 may be made to appear outside frequently.

[0025] And in order to guide sliding of this stroke detection rod 51, as shown in drawing 1 , this stroke detection rod 51 is inserted in the guide tube 6. This guide tube 6 is what fixed the end face of the body 60 of a tube which has flexibility in end-plate 31b with the nut 61 for anchoring, and fixed the fixed plate 62 at that tip with the same nut 63 for anchoring, inserts the stroke detection rod 51 in the feed hole 64 in the fixed plate 62, and is making the opening edge of a feed hole 64 face that tip. Although the above-mentioned body 60 of a tube can be formed by a synthetic-resin pipe-like member with flexibility etc., it can also be formed by the coiled form member of a metal or synthetic resin, and it can also be further formed by the member which combined mechanically metallic coiled form member 60a and coiled form member 60b of synthetic-resin nature so that it may illustrate to drawing 4 . Moreover, shape memory nature can also be given to those members so that it may mention later.

[0026] The hydrostatic pressure cylinder with a stroke sensor which has the above-

mentioned configuration On the occasion of measurement of the location of a measuring object object, or a dimension, the tip of the stroke detection rod 51 is beforehand doubled with a suitable measurement criteria location. The collet chuck 35 in the chuck holder 30 is made to support this rod 51. Existence of a measuring object object, a location, and a dimension As migration length of the piston 14 until the tip of the stroke detection rod 51 contacts a measuring object object from that criteria location, although it measures by the location detection sensor 20, this measurement criteria location can be set up suitably.

[0027] That is, although location measurement of an object and dimension measurement will be performed in the above-mentioned hydrostatic pressure cylinder with a stroke sensor, avoiding an obstruction with the stroke detection rod 51, the tip of a rod 51 will not take a fixed location in the tip of the guide tube 6 by crookedness of the guide tube 6 in this case. By for example, the case where the stroke detection rod 51 and the body 60 of a tube are made crooked in drawing 1 as a continuous line shows and the case where it arranges almost linearly as the chain line shows to this drawing The crookedness condition of the stroke detection rod 51 within the body 60 of a tube is different. The sake, If the stroke detection rod 51 is made to support to the chuck holder 30 in a fixed location, even if a piston 14 is in a non-operative location, the amount of protrusions of the stroke detection rod 51 from the feed hole 64 of the fixed plate 62 at a tip changes with differences in the above-mentioned crookedness condition.

[0028] Doubling the tip of the stroke detection rod 51 with a measurement criteria location The difference in the amount of protrusions of such a stroke detection rod 51 is abolished. Irrespective of the crookedness condition of the stroke detection rod 51 and the body 60 of a tube It is for the location detection sensor 20 always detecting the location of an object etc. by making a fixed location into a criteria location (zero point).

Therefore, a measurement criteria location What is necessary is not to especially essentially specify noting that it is which location, and just to set it as a suitable location on the occasion of use, although it considers as the tip side vent edge of the feed hole 64 of the fixed plate 62, and the tip of the stroke detection rod 51 is generally located in the location at drawing 1 as a continuous line shows.

[0029] In order to double the tip of the stroke detection rod 51 with a measurement criteria location, a rod 51 is made to appear frequently by actuation of the chuck holder 30 so that the tip of this rod may be doubled with the measurement criteria location suitably set as the point of the guide tube 6. What is necessary is to be in the location which cannot view a measurement criteria location, to make the guide tube 6 crooked in the same condition as the busy condition, and just to double the tip of a rod 51 with a measurement criteria location in the condition, when it is difficult to double a measurement criteria location for the tip of a rod 51.

[0030] It is measured as migration length of the piston 14 from a measurement criteria location by the location detection sensor 20 attached to the cylinder 10 whether the predetermined proper location is supplied and whether the measuring object object is processed into the predetermined dimension by setup of such a measurement criteria location. Consequently, when they of a crookedness path or an obstruction have the supply location of a measuring object object, measurement of the dimension to the measuring object object from a measurement criteria location, the dimension inside the hole of small aperture, etc. is attained to detect whether processing predetermined in a narrow location like the interior of the hole of small aperture is performed. Moreover, if it

is detected that it is within limits with the proper tip location of this rod 51 in the location detection sensor 20 at the time of measurement, an object shall exist in a normal location, and detection of the existence or nonexistence of a measuring object object will become having no object, if the tip location of this rod 51 becomes within proper limits.

[0031] Sequential supply of the measuring object object (work piece) B is carried out at the point of Obstruction A, processing of the hole C of a predetermined dimension is performed in the measuring object object B, and drawing 5 lets the through-hole D to which it is prepared in which by Obstruction A whether it is supplied with the posture with proper it, and the supply location of a measuring object object was made it to carry out opening pass, and shows typically the case where measurement is made possible with the stroke detection rod 51. Moreover, drawing 6 lets the through-hole G which leads in the work-piece insertion hole F in processing equipment E pass, and shows typically the case where existence of supply of the measuring object object (work piece) H is made measurable with the stroke detection rod 51. It is not necessary to prepare the guide tube which can replace with and use the above-mentioned through-holes D and G for the guide tube 6 in these cases, therefore has flexibility. However, the path of Through-holes D and G is large to some extent, and when the guide tube 6 can be inserted in it, even if it uses a guide tube, it does not interfere. When the slot which can be replaced with and used for the guide tube 6 is in processing equipment E, it is not necessary to prepare a guide tube similarly. Moreover, a measurement criteria location is set as the opening edge of the measurement object supply location in Through-hole D; the opening edge of the work-piece insertion hole F in Through-hole G, or the method of the inside of some [those].

[0032] Using a fiber-optic cable as a stroke detection rod 51, through the inside of the cable, from the projector within the optical fiber interface 44, project light on the front face of an object and the reflected light from an object front face is received in an electric eye. Although it is necessary to proofread beforehand according to the object since it faces detecting the approach of an object to a stroke detection rod tip, contact, etc. and the amount of reflected lights is different according to the description on the front face of an object Since the amount of reflected lights generally increases as the tip of a fiber-optic cable approaches an object front face, The light-receiving output corresponding to the contact or approach at the tip of a stroke detection rod to the above-mentioned measuring object object is set as the detection control unit 52, and when the light-receiving output is detected, the control signal for performing required control in the detection control unit 52 is made to output.

[0033] By this, contiguity of the measuring object object to the existence or this cable tip of a measuring object object is detectable, it detects that the tip of a fiber-optic cable approached before [several mm] the measuring object object by fluctuation in the that case of reflected lights, for example, the amount, a switching device is operated, and behavior control of the cylinder 10 of adjusting the drive rate of a piston is also attained by control of the driving pressure force of a cylinder 10 in the location. Moreover, by using this fiber-optic cable, damage by the collision to the object of the **** itself prepared in the tip of this cable or there is prevented, or detection of that damage [itself] is also attained.

[0034] In addition, without considering as a fiber-optic cable, elastically, it can also form with a wire rod suitably and the above-mentioned stroke detection rod 51 can also be made into the configuration made from a ***** synthetic-resin metallurgy group to

which the cross-section configuration is not a circle simple form, either, and directivity is in crookedness of an ellipse form, a square, a rectangle, etc. Of course in these cases, the above-mentioned detection control unit 52 is unnecessary. Anyway, although the above-mentioned stroke detection rod 51 has ***** elastically, when a piston drives, only the stroke and ** length need to give rigidity in which a tip projects.

[0035] Drawing 7 shows the case where the guide tube 70 with shape memory nature is used in order to guide sliding of the stroke detection rod 51 by the drive of a hydrostatic pressure cylinder. A fixed configuration which bypasses Obstruction I as it is advantageous when, as for the guide tube 70 with this shape memory nature, it cannot vibrate by vibration of a machine, an impact, etc., and it cannot deform or the path of a guide tube cannot be hold uniformly, and illustrate, and reaches the measuring object object J is make to memorize, and a return in a former storage configuration is immediately enable at the time of deformation. This guide tube 70 can be made into a metal or the product made of synthetic resin, can be further made into a coiled form which was mentioned above, or can be made into structure as shown in drawing 4 .

[0036] The stroke detection rod 51 equipped with the above-mentioned guide tube 70 Although the tip of the stroke detection rod 51 beforehand set by the measurement criteria location will shift from this measurement criteria location when using it, attaching it in various machines etc., and this tube 70 may deform by vibration of a machine, an impact, etc. or the location may change Since it has shape memory nature, it can inhibit that can return the configuration to the original storage configuration simply, therefore the tip of the stroke detection rod 51 shifts from a measurement criteria location.

[0037] Drawing 8 shows the 2nd example of the hydrostatic pressure cylinder with a stroke sensor concerning this invention. This 2nd example has the substantially same configuration of the air cylinder section 1 which consists of the cylinder 10 and the location detection sensor 20 of a hydrostatic pressure drive as compared with said 1st example. Moreover, the detection control unit 103 driven in the above-mentioned cylinder 10 Except for the point of having attached the body 60 of a tube of the guide tube 6 in the chuck holder 130 directly, those configurations are substantially the same, without having the case 31 of the shape of a cylinder established fixed to the cylinder 10.

[0038] That is, in this 2nd example, posterior part body 132b of the chuck holder 130 which supports the stroke detection rod 151 was fixed at the tip of a piston rod 15, anterior part body 132a of the chuck holder 130 was made to project ahead, the end face of the protective tubing 160 which has flexibility in that anterior part body 132a was fixed with the nut 161 for anchoring, and the stroke detection rod 151 is inserted in that protective tubing 160. This protective tubing 160 will use the stroke detection rod 151 which is for protecting the stroke detection rod 151, and drove with the piston rod 15 with this stroke detection rod 151, therefore was inserted in the protective tubing 160 for that rod tip with the chuck holder 130 according to those crookedness conditions at the time of use for the location which made only suitable die length project from a protective tubing 160, holding. In addition, in this 2nd example, in order not to have a thing equivalent to the case 31 of said 1st example, the detection control device 152 will be attached in the body of the chuck holder 130.

[0039]

[Effect of the Invention] As mentioned above, according to the hydrostatic pressure cylinder with this invention stroke sensor [when it is difficult to carry out sensing of the

location and processing condition of a measuring object object directly] The flexibility of a guide tube is used, it applies to the place which cannot be measured only by linear motion, and an obstruction is avoided. Further with the above-mentioned guide tube The measurement criteria location gap by vibration of a machinery can be prevented, as a result the existence or nonexistence of the measuring object object, the processing condition in a location or a narrow location, etc. can be detected correctly.

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TECHNICAL FIELD

[Industrial Application] For example, in a production line or a processing machine, in order to carry out supply arrangement of the measuring object object serially and to give them of a crookedness path or an obstruction a certain processing and processing to the measuring object object, it is not rare to perform detection of existence of the measuring object object itself or its supply location. Moreover, there is also a demand of wanting to detect whether processing predetermined in a narrow location like the interior of the hole of small aperture being performed.

[0002] This invention is used when it is difficult to carry out sensing of the location and processing condition of such a measuring object object directly, and it relates to the hydrostatic pressure cylinder with a stroke sensor for making it possible to detect the existence or nonexistence of the measuring object object, the processing condition of a location or a narrow location, etc.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] In a production line or a processing machine, if the processing and processing by the processing machine are performed in the condition that a measuring object object shifts from the supply location of normal, and it moves, or there is nothing into the installation posture of normal when supply arrangement is carried out and a measuring object object is serially processed on a processing location, a tool and a measuring object object may be damaged. In order to prevent this, it is necessary to perform detection of the existence or nonexistence or the location of the measuring object object itself, or a posture, and he usually arranges a certain sensor in the supply location of the measuring object object in that case beforehand, and is trying to detect that the measuring object object was supplied there correctly.

[0004] Like variety production, however, when the configuration of a measuring object object always is not fixed A sensor cannot be arranged in the supply location of a measuring object object fixed in many cases. When they of a crookedness path or an obstruction have the supply location of a measuring object object especially, monitor by viewing and detection cannot be performed, either but offer of the sensor which can be attached simply is desired to detect whether processing predetermined in a narrow location like the interior of the hole of small aperture is performed. Moreover, since the measuring object object supplied to the position shifts from the supply location of normal and moves by the location gap at the time of vibration of a machine or supply etc., in order to perform reliable detection, offer of the sensor which can be additionally installed in the existing device if needed is also desired.

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EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, according to the hydrostatic pressure cylinder with this invention stroke sensor [when it is difficult to carry out sensing of the location and processing condition of a measuring object object directly] The flexibility of a guide tube is used, it applies to the place which cannot be measured only by linear motion, and an obstruction is avoided. Further with the above-mentioned guide tube The measurement criteria location gap by vibration of a machinery can be prevented, as a result the existence or nonexistence of the measuring object object, the processing

condition in a location or a narrow location, etc. can be detected correctly.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention tends to offer the sensor which fills the demand mentioned above, and the technical technical problem is in offering the hydrostatic-pressure cylinder with a stroke sensor which can detect the existence or nonexistence of the measuring object object, the processing condition in a location or a narrow location, etc., when it is difficult to carry out sensing directly by the sensor in which the location and the processing condition of a measuring object object were attached by the device. Other technical technical problems of this invention are to offer the hydrostatic pressure cylinder with a stroke sensor whose setup of a metrics location was enabled while they guide the ***** stroke detection rod which a tip is contacted in a measuring object object and performs the existence and detection of a location with a guide tube and stabilize frequent appearance migration of the above-mentioned rod with the guide. By using a fiber-optic cable as the above-mentioned stroke detection rod, the technical technical problem of further others of this invention checks the physical relationship of the tip of this rod, and a measuring object object, and is to offer the hydrostatic pressure cylinder with a stroke sensor which enabled it to perform behavior control of a cylinder etc.

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MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, according to this invention, at the tip of the piston rod of a hydrostatic pressure cylinder Attach the chuck holder with which the stroke detection rod elastically formed with the ***** wire rod was made to support, and it sets to the above-mentioned chuck holder. Immobilization of the stroke detection rod which it was made to support is enabled in the location of arbitration at shaft orientations. The hydrostatic pressure cylinder with a stroke sensor characterized by attaching the location detection sensor which detects the tip location of a stroke detection rod with the movement magnitude of the piston to the above-mentioned hydrostatic pressure cylinder is offered.

[0007] Moreover, according to this invention, in the above-mentioned hydrostatic pressure cylinder, a guide tube with the flexibility for guiding sliding of the stroke detection rod by the drive of this hydrostatic pressure cylinder or a guide tube with shape memory nature is prepared, this rod is inserted free [sliding], and the hydrostatic pressure cylinder with a stroke sensor which set up the measurement criteria location at the tip of the guide tube is offered. Furthermore, according to this invention, the above-mentioned stroke detection rod is formed with a fiber-optic cable, and while carrying out opposite arrangement of the optical fiber interface which has a light emitter and receiver in the end face of this fiber-optic cable, the hydrostatic pressure cylinder with a stroke sensor which connected to that interface the detection control unit which detects the contact or approach at the tip of the above-mentioned rod to a measuring object object based on a light-receiving output is offered.

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OPERATION

[Function] According to the hydrostatic pressure cylinder with a stroke sensor which has the above-mentioned configuration, on the occasion of measurement of the location of a measuring object object, double the tip of a stroke detection rod with a measurement criteria location beforehand, but This measurement criteria location can be suitably set up according to the arrangement condition of this rod, and the proper location of a measuring object object applies the tip of the above-mentioned rod to an object by the drive of a hydrostatic pressure cylinder, and is measured by the location detection sensor as migration length of the piston from the above-mentioned measurement criteria

location. If there is this rod tip location within proper limits, an object shall exist in a normal location and an object will not be detected within proper limits in a location detection sensor in case the existence or nonexistence of a measuring object object are detected, it becomes having no object. Thus, measurement of the dimension to the object from a measurement criteria location, the dimension in a narrow location like the interior of the hole of small aperture, the existence or nonexistence of a measurement object, etc. is attained by the above-mentioned location detection sensor.

[0009] Furthermore, although location measurement of an object while avoiding an obstruction with this rod by preparing a guide tube with the flexibility for guiding sliding of the above-mentioned stroke detection rod, and dimension measurement are attained In this case, since the tip of a rod stops suiting the measurement criteria location set up at the tip of a guide tube by crookedness of a guide tube, What is necessary is to make a rod it appear frequently with slight accuracy that the tip of the above-mentioned rod suits beforehand the measurement criteria location suitably set up at the tip of a guide tube by actuation of a chuck holder, and just to double the tip with a measurement criteria location.

[0010] Moreover, if the path of the above-mentioned rod is set up by forming the above-mentioned guide tube for the material which has shape memory nature, since the path of this rod is fixable, Even if a guide tube may carry out oscillating deformation by vibration of a machine, an impact, etc. or the location may change, to return it to the storage configuration which is in a proper condition immediately; and the tip location of a rod seems not to be out of order to a measurement criteria location. If a fiber-optic cable is used as the above-mentioned stroke detection rod, by furthermore, the reflected light obtained through the inside of this cable Contiguity of the measuring object object to the existence or this cable tip of a measuring object object is detectable. By fluctuation in the that case of reflected lights, for example, the amount It detects that the tip of a fiber-optic cable approached before [several mm] the measuring object object, a switching device is operated, and behavior control of the cylinder of adjusting the drive rate of a piston is also attained by control of the driving pressure force of a cylinder in the location.

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EXAMPLE

[Example] It is what shows the 1st example of the hydrostatic pressure cylinder with a stroke sensor which drawing 1 thru/or drawing 3 require for this invention explaining to a

detail hereafter, referring to a drawing for the example of this invention. This hydrostatic pressure cylinder with a stroke sensor The air cylinder section 1 which consists of the cylinder 10 and the location detection sensor 20 of a hydrostatic pressure drive roughly, It has the detection control unit 3 driven in the above-mentioned cylinder 10, and the guide tube 6 for guiding sliding of the stroke detection rod 51 held at the chuck holder 30 in this detection control unit 3. the detection control unit 52 which the above-mentioned detection control unit 3 was equipped with the chuck holder 30 which supports the stroke detection rod 51 which consists of a fiber-optic cable, and was connected to this stroke detection rod 51 -- external -- it is a thing the bottom.

[0012] The above-mentioned air cylinder section 1 consists of a cylinder 10 and a location detection sensor 20, as shown in a detail at drawing 2 . The above-mentioned cylinder 10 While fixing airtightly a cylinder-head cover 12 and a rod cover 13 to the centrum both ends of a cylinder tube 11 and interpolating a piston 14 in them free [sliding] among these coverings Make a rod cover 13 penetrate the piston rod 15 of this piston 14 and one airtightly and free [sliding], it is made to project outside, and opening of the ports 17a and 17b is carried out to head room 16a and rod room 16b which were divided at the piston 14, respectively. And the magnetic scale 18 which has the magnetic memory which prepared the magnetic part and the nonmagnetic part in the side face of the above-mentioned piston rod 15 at fixed spacing by turns is attached in the direction of an axis.

[0013] The location detection sensor 20 consists of a magnetometric sensor 21 which detects the above-mentioned magnetic scale 18, and circuit block 22 which built in the digital disposal circuit which processes the detecting signal from this magnetometric sensor 21. The above-mentioned magnetometric sensor 21 consists of permanent magnet 21a which generates magnetic flux, and magnetic resistance elements 21b and 21c which are two from which electric resistance changes according to flux density, in the hold circles prepared in the cylinder tube 11 and the rod cover 13, it is arranged so that the magnetic scale 18 on the above-mentioned piston rod 15 may be attended, and it is being fixed to the location with the bracket 23 attached in the cylinder tube 11. If the magnetic scale 18 displaces this magnetometric sensor 21 by the drive of the above-mentioned piston 14, the sinusoidal signal of the period according to spacing of magnetic memory will be acquired by two magnetic resistance elements 21b and 21c, respectively.

[0014] Furthermore, the above-mentioned circuit block 22 holds the ceramic substrate 24 and the synthetic-resin substrate 25 which carried out division loading of the above-mentioned digital disposal circuit in metal casing 26 at a laminating condition. It is what was constituted by carrying out the mold of both the substrates to one with synthetic resin in the condition of having connected circuits mutually. This circuit block 22 is fixed to a cylinder tube 11 with a screw 27, and the digital disposal circuit in this circuit block is connected with the above-mentioned magnetometric sensor 21 by the flexible print code 28.

[0015] The above-mentioned digital disposal circuit consists of the differential amplifier section which amplifies the detecting signal from the above-mentioned magnetometric sensor 21, an electrical-potential-difference comparator which subdivided the amplified signal electrically and was equipped with the comparator of a large number in comparison with a reference value, and the logical-operation section which changes and outputs the output signal from this electrical-potential-difference comparator to a pulse

signal, and detects the movement magnitude of the above-mentioned piston rod 15 by carrying out counting of the pulse number outputted from this logical operation section with a counter. The movement magnitude of the tip location of the stroke detection rod 51 is detected by the movement magnitude of this piston rod. In addition, about the detailed configuration of the above-mentioned location detection sensor 20, it is indicated by JP,3-96704,A, for example.

[0016] On the other hand, said detection control unit 3 is held for the direction of an axis in the case 31 of the shape of a cylinder which formed the chuck holder 30 for supporting the stroke detection rod 51 fixed to the cylinder 10, enabling free sliding, as shown in drawing 1 . Fix the body of the chuck holder 30 at the tip of the above-mentioned piston rod 15, and the above-mentioned stroke detection rod 51 is formed with a fiber-optic cable. the detection control unit 52 for detecting and controlling the light emitting/receiving to the rod 51 in a case 31 -- external -- it is a thing the bottom and the guide tube 6 for guiding sliding of the direction of an axis of the above-mentioned stroke detection rod 51 is connected at the tip of the above-mentioned case 31.

[0017] As shown in a detail at drawing 3 , the above-mentioned chuck holder 30 is equipped with anterior part body 32a and posterior part body 32b which ****ed mutually and were combined, and is arranging the collet chuck 35 for supporting and releasing the above-mentioned stroke detection rod 51 for the direction of an axis in the feed hole 33 of anterior part body 32a, enabling free sliding. This collet chuck 35 equips a part of that periphery with taper side 35a whose diameter is reduced from a tip side to a end face side. It is what ****(ed) two or more slits (illustration abbreviation) of the direction extended from a core to a radial, and divided this part into the tip side of the collet chuck 35 containing the part at plurality. The taper side 35a is made to contact taper-like inside 33a in the above-mentioned feed hole 33, and it forms in the core possible [support and release of the stroke detection rod 51] by the expanding and contracting accompanying shaft-orientations migration of a collet chuck 35.

[0018] Moreover, the conical cam 36 which has in a perimeter the above-mentioned taper side 35a and conical-surface 36a whose diameter was reduced in this direction at the above-mentioned collet chuck 35 is screwed on the end face side. The body prolonged from the diameter expansion section of the above-mentioned conical-surface 36a ****s to the inner skin of anterior part body 32a, and it is shown to sliding to the shaft orientations of this conical cam 36 to this conical cam 36, and further, it **** the backup spring 37 between that conical cam 36 and the above-mentioned anterior part body 32a, and is energized in the direction in which a collet chuck 35 reduces the diameter of the hole of that core with this spring 37.

[0019] On the other hand, the release ring 38 of which support of the above-mentioned stroke detection rod 51 is made to cancel by energization to the diameter reduction direction is arranged in the perimeter of conical-surface 36a of a conical cam 36 in the above-mentioned anterior part body 32a. This release ring 38 excises a part of ring-like member, and it is energized in the extension direction with the return spring 39 attached in the inner circumference. Moreover, by fitting into the actuation hole 40 which attached around anterior part body 32a small projection 38a which protruded on several [around this release ring 38], respectively The device for canceling support of the stroke detection rod 51 by the collet chuck 35 is made to form, preventing migration to the shaft orientations of the above-mentioned release ring 38.

[0020] Namely, since the above-mentioned release ring 38 is making the small projection 38a face outside through the actuation hole 40 of anterior part body 32a. If the diameter of the open ring 38 is made to reduce and those small projection 38a is suitably pressed inside with a means. The diameter of the release ring 38 will be reduced and conical-surface 36a of a conical cam 36 will be pressed by the inner skin. Therefore, a conical cam 36 resists the energization force of the backup spring 37, it slides in the direction of an axis, the slit section of the above-mentioned collet chuck 35 opens, and support of the stroke detection rod 51 is released. In order to hold in the condition of having released support of the above-mentioned stroke detection rod 51, or having released it, the release auxiliary ring 41 attached in the perimeter of anterior part body 32a can also be used.

[0021] This release auxiliary ring 41 excises a part of ring-like elastic member energized in the diameter reduction direction. Boss 41a which bound tight to anterior part body 32a, was attached in the condition, and opposite-**(ed) to small projection 38a of the above-mentioned release ring 38 in several inner circumference by fitting into the slot 43 which stands in a row in the actuation hole 40 of anterior part body 32a, respectively. It is what made movable the periphery of anterior part body 32a to shaft orientations. By actuation of this release auxiliary ring 41. Support of the stroke detection rod 51 by the collet chuck 35 can be canceled like the case where it mentions above, by moving the boss 41a to the location of the above-mentioned actuation hole 40, and holding in the condition of having pressed small projection 38a of the release ring 38 to the inner direction. Diameter reduction actuation of the open ring 38 mentioned above is performed through two or more actuation hole 31c (refer to drawing 1) prepared in said case 31 where the chuck holder 30 is held.

[0022] The above-mentioned stroke detection rod 51 formed with the fiber-optic cable which has a ***** property elastically is supported by the location of the arbitration of shaft orientations possible [immobilization] by the collet chuck 35 in the above-mentioned chuck holder 30, and opposite arrangement of the optical fiber interface 44 which has a light emitter and receiver is carried out at the end face. This optical fiber interface 44 is energized through the holder 45 attached in it in the direction which makes the stroke detection rod 51 project with the bias spring 46 infixed between posterior part body 32b, and is further connected to the above-mentioned case 31 by the flexible cable 47 at the external ***** detection control unit 52 (refer to drawing 1).

[0023] The above-mentioned optical fiber interface 44 is equipped with the projector which projects light on the surface of an object through the inside of a fiber-optic cable, and the electric eye which receives the reflected light from an object front face, and is outputted to the above-mentioned detection control unit 52. Moreover, the above-mentioned detection control unit 52 detects the contact or approach at the tip of the above-mentioned stroke detection rod to a measuring object based on the light-receiving output of an electric eye, outputs a required control signal, and holds in configuration the substrate in which the digital disposal circuit was carried in metal casing 53 like said circuit block 22 so that it may mention later.

[0024] As shown in drawing 1 , the cylinder-like case 31 where end-plate 31a was prepared fixed to the cylinder 10 prepares the flange for immobilization to various devices in end-plate 31b of another side, and is inserting in this end-plate 31b loosely the stroke detection rod 51 which the chuck holder 30 was made to support. The above-mentioned chuck holder 30 screws the tip of a piston rod 15 in the tapped hole 54 (refer

to drawing 3) established in the back end of the posterior part body 32b, and it holds it so that it may slide on the inside of a case 31 in the direction of an axis by the drive of a piston 14 and the supported stroke detection rod 51 may be made to appear outside frequently.

[0025] And in order to guide sliding of this stroke detection rod 51, as shown in drawing 1 , this stroke detection rod 51 is inserted in the guide tube 6. This guide tube 6 is what fixed the end face of the body 60 of a tube which has flexibility in end-plate 31b with the nut 61 for anchoring, and fixed the fixed plate 62 at that tip with the same nut 63 for anchoring, inserts the stroke detection rod 51 in the feed hole 64 in the fixed plate 62, and is making the opening edge of a feed hole 64 face that tip. Although the above-mentioned body 60 of a tube can be formed by a synthetic-resin pipe-like member with flexibility etc., it can also be formed by the coiled form member of a metal or synthetic resin, and it can also be further formed by the member which combined mechanically metallic coiled form member 60a and coiled form member 60b of synthetic-resin nature so that it may illustrate to drawing 4 . Moreover, shape memory nature can also be given to those members so that it may mention later.

[0026] The hydrostatic pressure cylinder with a stroke sensor which has the above-mentioned configuration On the occasion of measurement of the location of a measuring object object, or a dimension, the tip of the stroke detection rod 51 is beforehand doubled with a suitable measurement criteria location. The collet chuck 35 in the chuck holder 30 is made to support this rod 51. Existence of a measuring object object, a location, and a dimension As migration length of the piston 14 until the tip of the stroke detection rod 51 contacts a measuring object object from that criteria location, although it measures by the location detection sensor 20, this measurement criteria location can be set up suitably.

[0027] That is, although location measurement of an object and dimension measurement will be performed in the above-mentioned hydrostatic pressure cylinder with a stroke sensor, avoiding an obstruction with the stroke detection rod 51, the tip of a rod 51 will not take a fixed location in the tip of the guide tube 6 by crookedness of the guide tube 6 in this case. By for example, the case where the stroke detection rod 51 and the body 60 of a tube are made crooked in drawing 1 as a continuous line shows and the case where it arranges almost linearly as the chain line shows to this drawing The crookedness condition of the stroke detection rod 51 within the body 60 of a tube is different: The sake, If the stroke detection rod 51 is made to support to the chuck holder 30 in a fixed location, even if a piston 14 is in a non-operative location, the amount of protrusions of the stroke detection rod 51 from the feed hole 64 of the fixed plate 62 at a tip changes with differences in the above-mentioned crookedness condition.

[0028] Doubling the tip of the stroke detection rod 51 with a measurement criteria location The difference in the amount of protrusions of such a stroke detection rod 51 is abolished. Irrespective of the crookedness condition of the stroke detection rod 51 and the body 60 of a tube It is for the location detection sensor 20 always detecting the location of an object etc. by making a fixed location into a criteria location (zero point). Therefore, a measurement criteria location What is necessary is not to especially essentially specify noting that it is which location, and just to set it as a suitable location on the occasion of use, although it considers as the tip side vent edge of the feed hole 64 of the fixed plate 62, and the tip of the stroke detection rod 51 is generally located in the location at drawing 1 as a continuous line shows.

[0029] In order to double the tip of the stroke detection rod 51 with a measurement criteria location, a rod 51 is made to appear frequently by actuation of the chuck holder 30 so that the tip of this rod may be doubled with the measurement criteria location suitably set as the point of the guide tube 6. What is necessary is to be in the location which cannot view a measurement criteria location, to make the guide tube 6 crooked in the same condition as the busy condition, and just to double the tip of a rod 51 with a measurement criteria location in the condition, when it is difficult to double a measurement criteria location for the tip of a rod 51.

[0030] It is measured as migration length of the piston 14 from a measurement criteria location by the location detection sensor 20 attached to the cylinder 10 whether the predetermined proper location is supplied and whether the measuring object object is processed into the predetermined dimension by setup of such a measurement criteria location. Consequently, when they of a crookedness path or an obstruction have the supply location of a measuring object object, measurement of the dimension to the measuring object object from a measurement criteria location, the dimension inside the hole of small aperture, etc. is attained to detect whether processing predetermined in a narrow location like the interior of the hole of small aperture is performed. Moreover, if it is detected that it is within limits with the proper tip location of this rod 51 in the location detection sensor 20 at the time of measurement, an object shall exist in a normal location, and detection of the existence or nonexistence of a measuring object object will become having no object, if the tip location of this rod 51 becomes within proper limits.

[0031] Sequential supply of the measuring object object (work piece) B is carried out at the point of Obstruction A, processing of the hole C of a predetermined dimension is performed in the measuring object object B, and drawing 5 lets the through-hole D to which it is prepared in which by Obstruction A whether it is supplied with the posture with proper it, and the supply location of a measuring object object was made it to carry out opening pass, and shows typically the case where measurement is made possible with the stroke detection rod 51. Moreover, drawing 6 lets the through-hole G which leads in the work-piece insertion hole F in processing equipment E pass, and shows typically the case where existence of supply of the measuring object object (work piece) H is made measurable with the stroke detection rod 51. It is not necessary to prepare the guide tube which can replace with and use the above-mentioned through-holes D and G for the guide tube 6 in these cases, therefore has flexibility. However, the path of Through-holes D and G is large to some extent, and when the guide tube 6 can be inserted in it, even if it uses a guide tube, it does not interfere. When the slot which can be replaced with and used for the guide tube 6 is in processing equipment E, it is not necessary to prepare a guide tube similarly. Moreover, a measurement criteria location is set as the opening edge of the measurement object supply location in Through-hole D, the opening edge of the work-piece insertion hole F in Through-hole G, or the method of the inside of some [those].

[0032] Using a fiber-optic cable as a stroke detection rod 51, through the inside of the cable, from the projector within the optical fiber interface 44, project light on the front face of an object and the reflected light from an object front face is received in an electric eye. Although it is necessary to proofread beforehand according to the object since it faces detecting the approach of an object to a stroke detection rod tip, contact, etc. and the amount of reflected lights is different according to the description on the front face of an object Since the amount of reflected lights generally increases as the tip of a fiber-

optic cable approaches an object front face, The light-receiving output corresponding to the contact or approach at the tip of a stroke detection rod to the above-mentioned measuring object object is set as the detection control unit 52, and when the light-receiving output is detected, the control signal for performing required control in the detection control unit 52 is made to output.

[0033] By this, contiguity of the measuring object object to the existence or this cable tip of a measuring object object is detectable, it detects that the tip of a fiber-optic cable approached before [several mm] the measuring object object by fluctuation in the that case of reflected lights, for example, the amount, a switching device is operated, and behavior control of the cylinder 10 of adjusting the drive rate of a piston is also attained by control of the driving pressure force of a cylinder 10 in the location. Moreover, by using this fiber-optic cable, damage by the collision to the object of the **** itself prepared in the tip of this cable or there is prevented, or detection of that damage [itself] is also attained.

[0034] In addition, without considering as a fiber-optic cable, elastically, it can also form with a wire rod suitably and the above-mentioned stroke detection rod 51 can also be made into the configuration made from a ***** synthetic-resin metallurgy group to which the cross-section configuration is not a circle simple form, either, and directivity is in crookedness of an ellipse form, a square, a rectangle, etc. Of course in these cases, the above-mentioned detection control unit 52 is unnecessary. Anyway, although the above-mentioned stroke detection rod 51 has ***** elastically, when a piston drives, only the stroke and ** length need to give rigidity in which a tip projects.

[0035] Drawing 7 shows the case where the guide tube 70 with shape memory nature is used in order to guide sliding of the stroke detection rod 51 by the drive of a hydrostatic pressure cylinder. A fixed configuration which bypasses Obstruction I as it is advantageous when, as for the guide tube 70 with this shape memory nature, it cannot vibrate by vibration of a machine, an impact, etc., and it cannot deform or the path of a guide tube cannot be hold uniformly, and illustrate, and reaches the measuring object object J is make to memorize, and a return in a former storage configuration is immediately enable at the time of deformation. This guide tube 70 can be made into a metal or the product made of synthetic resin, can be further made into a coiled form which was mentioned above, or can be made into structure as shown in drawing 4 .

[0036] The stroke detection rod 51 equipped with the above-mentioned guide tube 70 Although the tip of the stroke detection rod 51 beforehand set by the measurement criteria location will shift from this measurement criteria location when using it, attaching it in various machines etc., and this tube 70 may deform by vibration of a machine, an impact, etc. or the location may change Since it has shape memory nature, it can inhibit that can return the configuration to the original storage configuration simply, therefore the tip of the stroke detection rod 51 shifts from a measurement criteria location.

[0037] Drawing 8 shows the 2nd example of the hydrostatic pressure cylinder with a stroke sensor concerning this invention. This 2nd example has the substantially same configuration of the air cylinder section 1 which consists of the cylinder 10 and the location detection sensor 20 of a hydrostatic pressure drive as compared with said 1st example. Moreover, the detection control unit 103 driven in the above-mentioned cylinder 10 Except for the point of having attached the body 60 of a tube of the guide tube 6 in the chuck holder 130 directly, those configurations are substantially the same,

without having the case 31 of the shape of a cylinder established fixed to the cylinder 10. [0038] That is, in this 2nd example, posterior part body 132b of the chuck holder 130 which supports the stroke detection rod 151 was fixed at the tip of a piston rod 15, anterior part body 132a of the chuck holder 130 was made to project ahead, the end face of the protective tubing 160 which has flexibility in that anterior part body 132a was fixed with the nut 161 for anchoring, and the stroke detection rod 151 is inserted in that protective tubing 160. This protective tubing 160 will use the stroke detection rod 151 which is for protecting the stroke detection rod 151, and drove with the piston rod 15 with this stroke detection rod 151, therefore was inserted in the protective tubing 160 for that rod tip with the chuck holder 130 according to those crookedness conditions at the time of use for the location which made only suitable die length project from a protective tubing 160, holding. In addition, in this 2nd example, in order not to have a thing equivalent to the case 31 of said 1st example, the detection control device 152 will be attached in the body of the chuck holder 130.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the side elevation showing the 1st example of the hydrostatic pressure cylinder with a stroke sensor concerning this invention by the partial cross section.

[Drawing 2] It is the sectional side elevation of the air cylinder section of drawing 1.

[Drawing 3] It is the sectional side elevation of this chuck holder.

[Drawing 4] It is the sectional view showing an example of a guide tube.

[Drawing 5] It is the sectional view showing typically an example of use of the above-mentioned hydrostatic pressure cylinder with a stroke sensor.

[Drawing 6] It is the sectional view showing typically an example of other use of the above-mentioned hydrostatic pressure cylinder with a stroke sensor.

[Drawing 7] It is the sectional view showing typically an example of use of the hydrostatic pressure cylinder with a stroke sensor using a guide tube with shape memory nature.

[Drawing 8] It is the side elevation showing the 2nd example of the hydrostatic pressure cylinder with a stroke sensor concerning this invention by the partial cross section.

[Description of Notations]

14 Piston

15 Piston Rod
20 Location Detection Sensor
30,130 Chuck holder
51,151 Stroke detection rod

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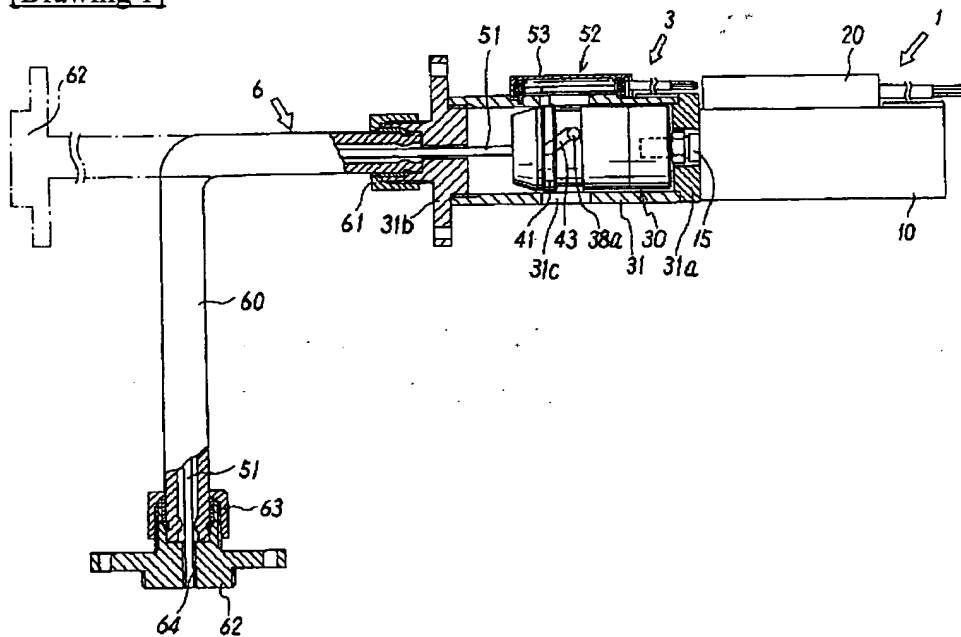
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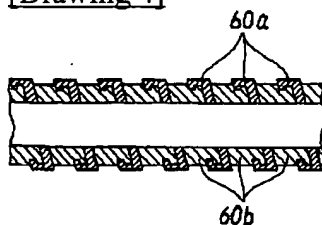
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DRAWINGS

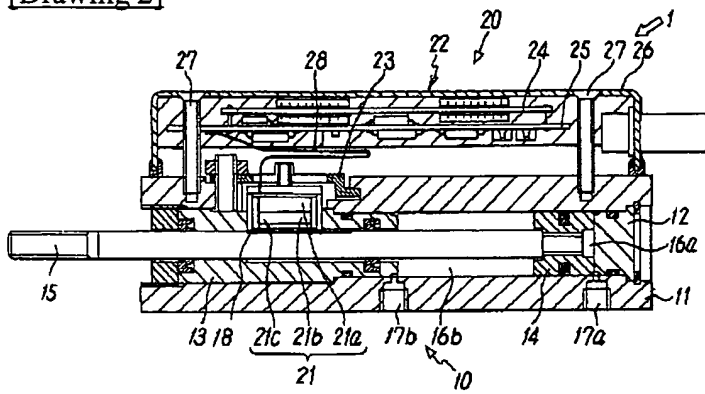
[Drawing 1]



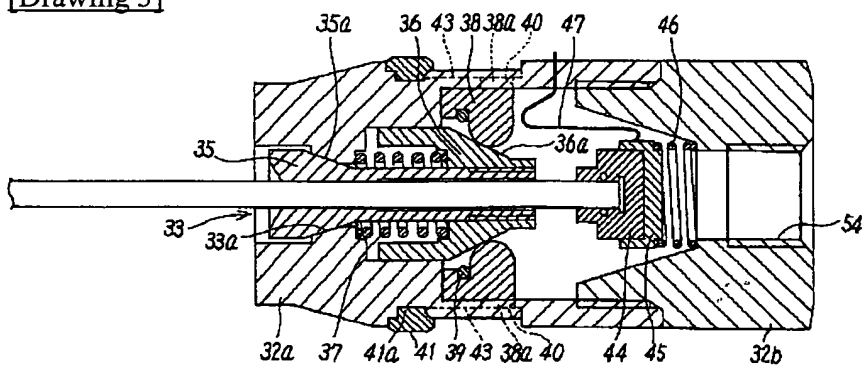
[Drawing 4]



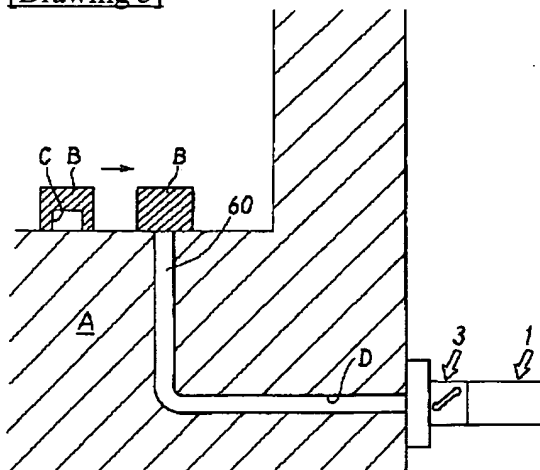
[Drawing 2]



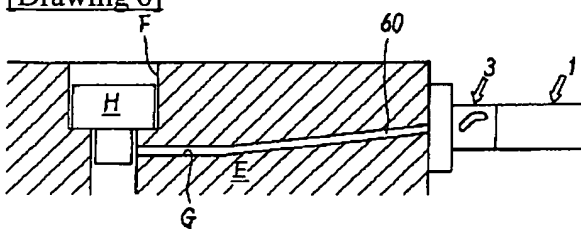
[Drawing 3]



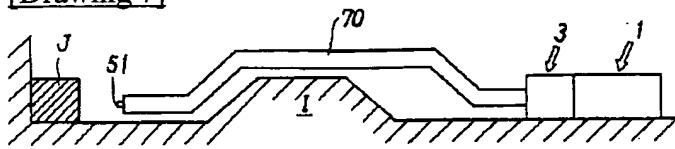
[Drawing 5]



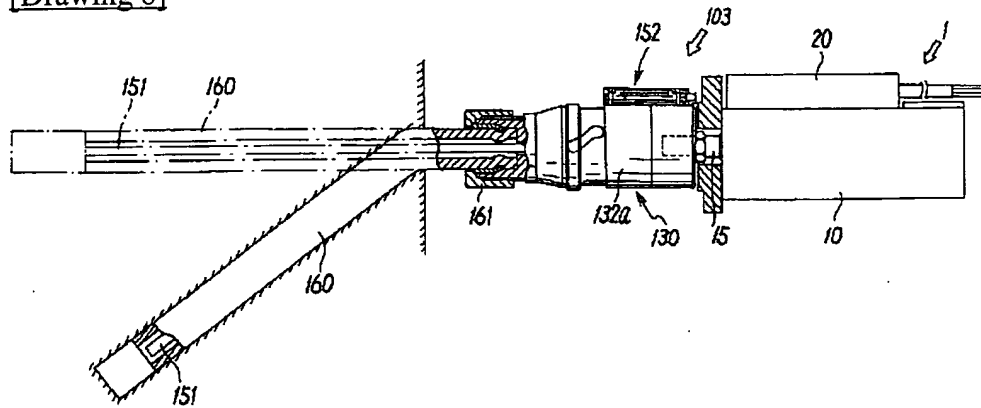
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]